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Nonlinear dynamics of 3D beams of fast magnetosonic waves propagating in the ionospheric and magnetospheric plasma

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Abstract

© 2016, Pleiades Publishing, Ltd.On the basis of the model of the three-dimensional (3D) generalized Kadomtsev-Petviashvili equation for magnetic field h = B~/B the formation, stability, and dynamics of 3D soliton-like structures, such as the beams of fast magnetosonic (FMS) waves generated in ionospheric and magnetospheric plasma at a low-frequency branch of oscillations when β = 4πnT/B2 ≪ 1 and β > 1, are studied. The study takes into account the highest dispersion correction determined by values of the plasma parameters and the angle θ = (B, k), which plays a key role in the FMS beam propagation at those angles to the magnetic field that are close to π/2. The stability of multidimensional solutions is studied by an investigation of the Hamiltonian boundness under its deformations on the basis of solving of the corresponding variational problem. The evolution and dynamics of the 3D FMS wave beam are studied by the numerical integration of equations with the use of specially developed methods. The results can be interpreted in terms of the self-focusing phenomenon, as the formation of a stationary beam and the scattering and self-focusing of the solitary beam of FMS waves. These cases were studied with a detailed investigation of all evolutionary stages of the 3D FMS wave beams in the ionospheric and magnetospheric plasma.

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